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VETERINARY JOURNAL

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Editorial

PHILANTHROPY TO ANIMALS.

A SICK animal, whether belonging to a poor man or a rich man, has a distinct moral right to have its ailment properly diagnosed, and to be properly treated, if veterinary aid can be obtained—and there is no place in England where the services of a veterinary surgeon cannot be obtained. To allow the poor, helpless beast to be prescribed for and experimented upon by untrained, and therefore, unqualified men, is not only unnecessary but morally wrong, and it is time that someone took up the cudgel on its behalf. It is not as if the veterinary profession had refused to help. They have always helped the animals of the poor, and it is for Societies who profess to be humane towards animals to see that the sick animal gets the *best* of skill and care—and this, where the diagnosis and treatment of illness of animals is concerned, can only be given by the qualified veterinary surgeon.

What would the general public say if sick and invalid children had their ailments diagnosed and treated by herbalists and pretenders to medical knowledge of this kind? Fortunately for human patients, the death certificate prevents the unqualified man from going on too long, but with the helpless animal there is no such protection. The avowed object of most of these philanthropic animal

societies is good—and they do good work—but the veterinary service cannot be adequately supplied by any but veterinary surgeons. Our Dumb Friends' League, The Royal Society for the Prevention of Cruelty to Animals, The Canine Defence League, and certain private animal humane societies, such as those at Croydon and Newcastle-on-Tyne, acknowledge this, but not the officials of the People's Dispensaries for Sick Animals; and the sooner they do so the better it will be for the poor beasts whose sufferings they state they wish to alleviate.

The present ambitions of this body are best set out by a quotation from its official organ, *The Animals' Advocate*, for September, 1928, and we publish on another page a ground plan and sketch of their "Sanatorium"; together with an article entitled "A Day's Work at the Sanatorium," by a P.D.S.A. official, in which it is asserted that the "junior assistants from the many dispensaries in London" receive "tuition" in the lecture room, and are taught "chemistry, physics, botany, zoology, anatomy, and physiology; and, in addition, are put through the practical work in the stables"; whilst "those students in the higher grades go through a course of clinical medicine . . . . just as the medical student in his training has to 'walk' the hospital wards." Students of the lower grades "do practical anatomy," and those in the higher grades "are shown pathological sections and attend classes in surgical anatomy, at which they are taught how to perform the more common operations. All this teaching is under the direct personal supervision of the Chief of the Technical Staff, whose main ambition is to turn out men with a complete knowledge of the subject of veterinary medicine and surgery."

We are giving publicity to this Society because we feel that the moment has come, when the veterinary profession should realise that there is in its midst, in this year of grace, 1928 an organisation for the treatment of sick animals, staffed by unqualified men; an organisation, moreover, which is continually appealing to the animal-loving British public for money on the grounds that it is for the "treatment" of the sick animals of the poor. We feel, and in this we must carry with us every lover of animals, that there is no service too good, no training too prolonged, no dexterity too great, to enlist in the relief of animal distress and suffering, and we, therefore, are at a loss to understand why a philanthropic body like the People's Dispensary for Sick Animals should be attempting to impose on the public a pretence of the *best* service; and on the beasts themselves the suffering which must ensue from unqualified treatment. We cannot help hoping that the governing body of this Society will seriously consider the consequences of their present policy.

General Articles

REMARKS ON A CURATIVE DISTEMPER REMEDY (A Preliminary Note on a Distemper Investigation).

By S. G. BILLINGTON, M.B., B.S., F.R.C.S.,
Leamington Spa.

For over five years I have been investigating distemper from the bacteriological side. The main object of this note is to describe the origin and nature of a product, which has been in clinical use for more than five years. In addition to supplying the scientific information sought, it has incidentally proved to be a very useful curative agent. As it has now fulfilled the essential primary object of its production for clinical use, it would be discarded from the scientific aspect. One is continually provided, however, with a good deal of evidence, that it might be in considerable demand, for the every-day practical purpose of curing a common canine malady.

The essential portion of this note will extend into a very controversial field of bacteriology, and to avoid any additional or secondary issues as to the exact meaning or significance of immunological terms, I will refer to the product as Distemper Inoculin, merely to indicate that it is administered via a needle.

The scope of this note is covered by remarks under the following three headings :—

(1) The Essential Object of the Investigation.
(2) The Method of Preparing the Inoculin.
(3) A Description of the Bacillary Organism, which Comprises the Essential Constituent of the Remedy.

The Essential Object of the Investigation.

The essential object of the investigation, started about six years ago, was to attempt to obtain some information about the bacterial life cycle ; and particularly to connect or otherwise the bacterium and filter-passer. Distemper was selected as a suitable disease for several reasons. It was more or less established that a filter-passer was the actual causal virus, while a great deal of work had been done, indicating that the bacillus bronchisepticus bore some close relationship to the disease. Finally, if it appeared that a virulent filter-passer had been grown from a non-virulent bacterium, the only final conclusive proof would be to produce the disease with the former, when the latter had failed to do so. That conclusive evidence would not be easy to obtain in a human disease.

The Composition of the Inoculin.

The bacillus, which I shall describe later, is the centre of interest in this communication. The Inoculin consists of an agglutinated emulsion of this bacillus. Such an agglutinated emulsion of an organism is, biochemically, very similar to, and in its effect clinically indistinguishable from, a sensitised vaccine.

Sensitised vaccines, as described by Besredka, are made by incubating an emulsion of the organism with the corresponding antibacterial serum. The organisms are agglutinated and deposit, are washed free from serum, and put up in carbolic saline ready for use. Such vaccines produce no reaction, the term sensitised being used to signify that the organisms have been sensitised to the attack of the leucocytes, the aggressins or other toxins having been neutralised by the antibacterial serum. Such a vaccine is supposed to consist of linked up antigen, complement, and antibody. As such it could

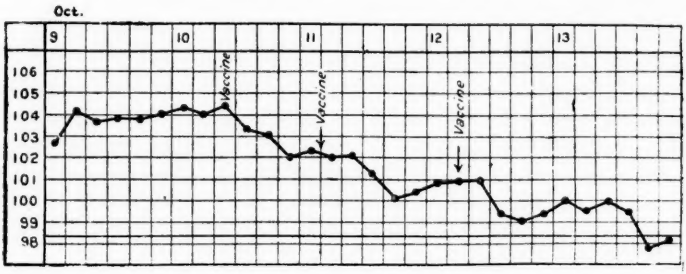

Fig. 1.
The chart of a lobar pneumonia in which a sensitised vaccine was administered on three consecutive days, the second, third, and fourth, days of the disease.

not neutralise any free antigen, and I have heard it stated that "Ehrlich's Theory of Immunity proves that such a vaccine must be quite inert, though harmless."

Anyone who has observed the clinical results, however, no matter how critically, must conclude that a very definite antibacterial action is exerted. Sensitised vaccines, in spite of Ehrlich's Theory of Immunity, do act, just as certainly as steel ships continue to float, in spite of the fact that mathematicians have proved by mathematics that they cannot do so.

In a sensitised vaccine it is the bacterium that is the specific element. A sensitised Type 1 pneumococcus has not the slightest effect on a Type 4 pneumococcal pneumonia. It is only the corresponding immune serum, however, that will sensitise, and a Type 1 serum will not sensitise a Type 4 coccus. A sensitised vaccine is most useful as it can be given in large doses in acute infections. There is

no reaction, and it is quite harmless if there is an error of diagnosis, the infecting organism being other than the one supposed.

The practical difficulties of producing them are that the correct immune serum may not be available and if it is such a vaccine is of necessity expensive to produce. An emulsion of bacteria, or hæmolysed red cells can be calcined and agglutinated artificially. Whatever the exact process may be, the end results are chemically similar, and the clinical effects indistinguishable from organisms agglutinated by the specific serum.*

As Regards Dosage.—In acute infections Besredka advocated a dose on three or four days at 24 hours interval, unless the infection subsided before, and with subsequent doses at three days interval when indicated. Such a routine seems to be extremely satisfactory, and I have never seen any indication to materially alter it. In distemper however, like diphtheria, a dose of antidote just sufficient to control

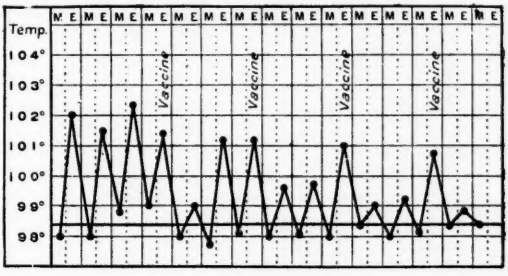

Fig. 2.
The chart of a puerperal white leg, showing how the vaccine controls the absorption from the thrombosed vein six to eight hours after administration, and how this control is lost in about forty-eight hours when the immunity response is beginning to diminish.

the febrile manifestations may be insufficient to prevent the nervous involvements, and for that reason it is advisable to give at least one good dose about two days after complete subsidence of the active disease. This point was illustrated very well in the case of a pack of fox hounds treated in May, 1923. It was a virulent outbreak, and three or four couples died in the first few days of the epidemic, before the Inoculin was used. The hounds responded extremely well, the huntsman inoculating the five or six fresh puppies developing the disease each day. Of the 20 or so couples affected, no dog died of the acute disease. In about a fortnight, however, four or five dogs developed chorea and had to be destroyed. It was found that all these dogs had apparently completely cleared up within 24 hours of their first inoculation, and had not been given any more.

* Billington—Auto-hæmo Therapy.—Lancet, March, 1924.

Assuming that the Inoculin is a reliable and efficient distemper antidote, in practical use there will be four groups of failures :—

(1) Errors of Diagnosis.—The Inoculin being sensitised will be quite harmless, but useless.

(2) Moribund Cases.—If the vital organs of the animal have

Charts of two representative cases of pneumonia, treated with pneumococci artificially agglutinated as described.

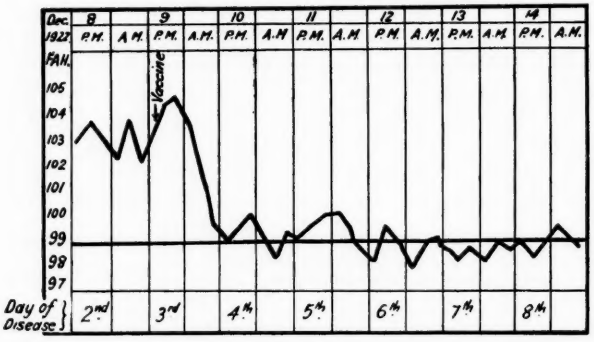

Fig. 3.
One large dose on the third day of the disease, produced a premature crisis, and completely controlled the infection.

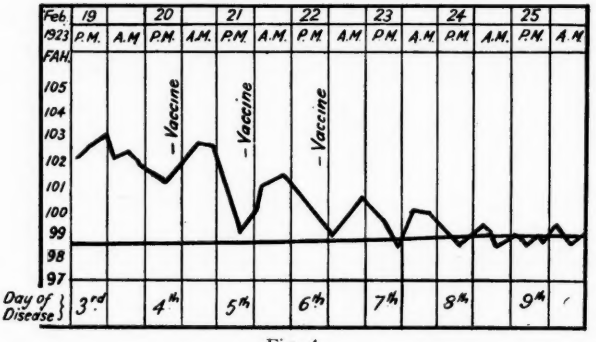

Fig. 4.
With smaller doses, the response is seen to occur in steps, as illustrated in the serum sensitised pneumococcal chart.

already received a lethal dose of toxin, no complete neutralisation of free toxin will avert a fatal issue. This also applies to the development of chorea, when the nerve cell toxin combination has materialised.

(3) Surgical Foci.—The presence of a closed collection of pus, such as an empyæma, will act as a sponge to absorb unlimited quantities of antidote, and the results will be nil.

(4) COMPLICATIONS.—When secondary organisms have gained access through breaches of intestinal or respiratory mucosa, initially produced by distemper, the animal may die. Clinically, such cases may be indistinguishable from distemper, though the distemper has been controlled, and death is due to a streptococcus or other organism. Some time ago a number of greyhounds were given the Inoculin in a small outbreak of gastro-intestinal distemper. They all appeared to respond within 48 hours; but clinically relapsed 36 hours later, and most of them died. I obtained blood cultures from two of these dogs in the early stages of the relapse, and both gave a pure growth of a streptococcus.

From the practical aspect it is most important to begin the specific treatment in the early stages.

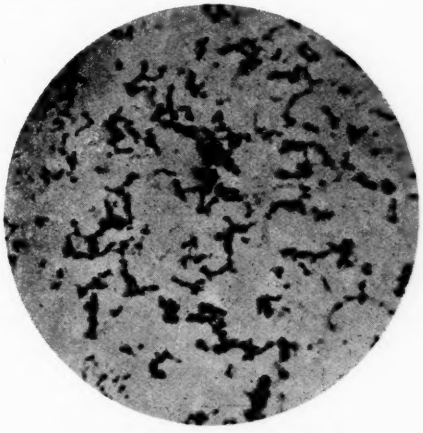

Fig. 5.
A film from an early positive blood culture.
This shows the large bacillary form appearing in pure culture.

I have kept a very open-minded, close, and critical observation on the clinical effects of Inoculin for over five years. As a result, I have come to the conclusion that the bacilli in the product do consistently exert a controlling effect on the filter-passing virus producing the disease. The amount and interval of dosage seem to be correct, and failure to respond can usually be traced either to one of the four causes mentioned above, or to a fault in the technique of preparation of the Inoculin.

The point that has surprised me in the consistency of the clinical results is that during the five years I have failed to detect any evidence of the existence of several distinct strains of the bacillus. I quite

expected to find conditions analogous to those in dysentery or cerebrospinal fever, but up to the present I have not found them.

The Bacillary Organism.

This is the element of essential interest in the communication. I shall tentatively call it the distemper lepto-thrix, as distinct from the distemper bacillus (Ferry's bacillus, *Bac. bronchisepticus*).

With the object of catching the bacterial stage of the distemper virus in the Spring of 1923, I took blood cultures from 40 dogs suffering from typical distemper. In 36 of these I grew the same bacillary organism. In a few it grew in pure culture, but in most there was one other organism, usually a coccus, staphylococci, streptococci and

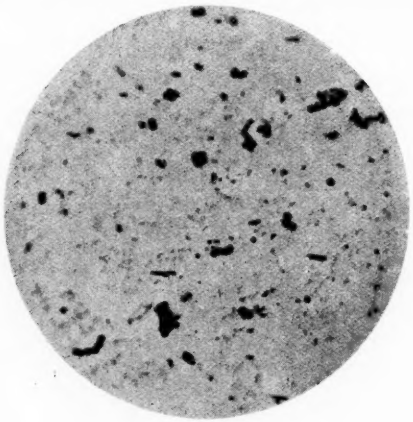

Fig. 6.
A film of the more usual results in blood culture of the distemper dog. This shows the bacillus as above, with an associated large staphylococcus.

pneumococci all appearing. The commonest combination was the bacillus with a large staphylococcus.

The unusual methods of culturing the blood that yielded these cultures, together with the cultural characteristics of the bacillus, I described to the Comparative Medicine Section of The Royal Society of Medicine in November, 1923.

At that time I was ignorant as to the significance of the organism caught. I now know, however, exactly what it is as regards the bacillus bronchisepticus. As regards its connection with the filter passer, I am not at the moment prepared to make any statements, beyond the fact that clinically it does definitely control the filter-passer in the animal.

For about five years I have had cultures of distemper bacillus

and distemper lepto-thrix growing side by side and reproducing and growing true to type indefinitely. In a few days, however, I have been able to grow either into the other at will, by culturing into the appropriate medium, in the necessary thermal environments.

Morphologically, the lepto-thrix is a large Gram negative bacillus about three times the size of the bacillus bronchisepticus. Its most striking characteristic is the fact that it will not grow at a temperature over 25° C. About 22° C. appears to be its optimum temperature, but it grows at the ordinary room temperature quite readily.

The bacillus and the lepto-thrix behave very differently in their emulsifying and precipitant properties with various reagents. The cause of this is a very definite difference in their chemical composition.

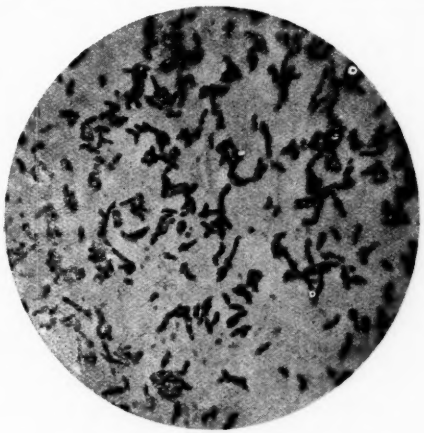

Fig. 7.
A typical film of the large bacillary stage of the distemper bacillus in pure culture.

Each contains a large proportion of a common element, which may be termed the specific antigenic protein. The lepto-thrix also contains a large amount of another protein, which I will call the globulin element. This chemical difference is the explanation of most of their different properties, and the essential function of the globulin element appears to be to act as a vehicle or mobiliser of the specific protein.

The lepto-thrix will emulsify readily in distilled water, the bacillus less readily and less completely. The globulin, on warming to 50-55° C. is precipitated by acetic acid. On this account acetic acid precipitates the lepto-thrix, but not the bacillus. These are two of the many differences demonstrable between the two organisms.

To bring about the required morphological change, the cultural

variations are based upon the specific-protein-globulin phenomenon. To obtain the lepto-thrix from the bacillus, the latter must be sown into a globulin containing medium, and neutral broth containing about 2 per cent. sterile serum suffices. The culture is left at room temperature for two or three days, and passage through several tubes of globulin broth may be necessary before the metamorphosis is complete.

To obtain the bacillus from the lepto-thrix, the object is to dissociate the globulin from the specific protein. An ordinary minus 6 broth with one-half per cent. glucose effects this. The glucose seems to have a definite dissociating effect.

The foregoing is a general description of two separate, self-contained

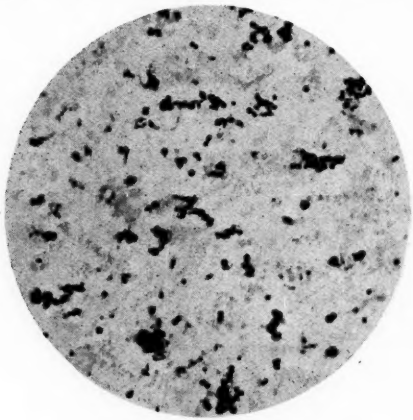

Fig. 8.
A representative film of an agglutinated streptococcal vaccine.
It shows the clumping of the cocci.

bacillary organisms. Each definitely represents a distinct stage in the life cycle of an organism, of which the bacillus bronchisepticus represents one stage.

What is the place of this so-called lepto-thrix stage in current bacteriology? There is no suggestion that this stage is anything new or unusual. It very definitely fits into that stage, universally recognised as existing in all organisms and usually referred to as primary cultures, before that change termed loss of virulence has occurred.

To mention two examples, the primary culture of the staphylococcus aureus is usually white, while a primary culture of a pneumococcus which will kill a mouse in 18-24 hours will often not do so after a few subcultures.

XUM

We know that the something termed presence of virulence is of vital importance to the action exerted by the organism, whether it be for good to control a disease, or for ill to produce a disease. The biochemical differences in the two bacillary stage described would seem to indicate that the presence or absence of virulence is dependent upon the presence or absence of a vehicle for the specific protein; the constituent called the globulin element functioning as the spirit to carry the iodine.

The distemper lepto-thrix very definitely corresponds to the primary cultures. In its chemical and physical properties it resembles the white staphylococcus aureus. I have had very striking evidence of the importance of the presence of the globulin element, when the bacillus is being used as a curative remedy. The Inoculin was first used in 1923, and for about a year the clinical results were consistently excellent. The product then went off and hardly touched the disease. I had not been personally checking the manufacture for some time and directed my attention to the change that had occurred. I quite expected to find that the explanation would be provided by the appearance of a fresh strain of bacillus. I found, however, that the cultures had passed to the bacillus bronchisepticus stage, and after getting them back to the globulin-containing stage, they acted as before.

Summary.

To summarise this preliminary note on a distemper investigation, I have attained two objects:—

(1) The bacillus bronchisepticus and the bacillary organism described represent two distinct, self-contained stages in the life cycle of a common organism. The difference in their maximum temperatures of growth has rendered their differentiation comparatively easy.

(2) Very strong clinical evidence has been obtained that a bacillary organism will control the filter-passer in the animal.

As regards the Inoculin from the practical aspect, it is merely a globulin-coated bacillus bronchisepticus. For the clinical effects, it is immaterial whether this globulin element is extracted from the immune serum, or whether it is acquired during growth in sterilized slaughter-house serum. From the economic aspect, however, the difference in the cost of production by the two methods is of necessity very great.

It is for the profession to decide whether there is a demand for this product as a self-supporting distemper remedy, or whether, having served the scientific purpose for which it was produced, it is to be scrapped.

Accurate knowledge regarding the etiology of distemper, as in

the case of so many infective diseases, is not likely to materialise until the filter-passer bacterium association has been determined.

The bacterium as an essential infecting causal agent is rapidly disappearing. Although the association of some bacteria with the causal virus is most intimate, there is a pronounced aversion on the part of many bacteriologists to admit the possibility of a cyclic association.

What, for example, is the relationship between the meningococcus, and the causal virus of spotted fever? Where the connection is very definite it has been suggested that the filter-passing virus is adsorbed to, or lives in a condition of close symbiosis with the bacterium.

Mervyn Gordon, in his work on the filter-passer of vaccinia, concluded that in many of its characteristics it resembled the bacteria.

The recent work on the filter-passing virus of tuberculosis, however, should force some issue. Are we to regard that veteran bacterial acquaintance, the tubercle bacillus, as merely a camp follower of the tuberculosis virus?

I am sure that the near future will establish the fact that the filter-passer and the bacterium are two distinct stages in the life cycle of the same organism. In this communication I claim to have described two distinct stages in the life-cycle of an organism closely associated with distemper.

In conclusion, I wish to express my very sincere appreciation and thanks to my veterinary friends who have collaborated and helped me so much in this work.

NEW METHODS IN ANIMAL BREEDING.

The Importance of Ultra Violet Light in Animal Breeding.*

In the breeding of animals, the rapid multiplication of pigs promises a good return to the farmer in comparison with the raising of stock and horses, because of the shortness of their life, their independence of raw food and the relatively small stallage accommodation required by these animals.

It will, therefore, be readily understood that when this branch of animal breeding is thoroughly well attended to and the production of cheap meat for food purposes is kept well in view, it will be more intensively pursued.

It is taken for granted that the profitable breeding of pigs naturally

* Report on the Control of Mortality among Swine, by Dr. Karl Schwab, Veterinary Surgeon. District Vet. Surgeon and Director of the Abbatoir in Diessen a/A., Upper Bavaria.

involves the consideration of every hygienic method and the selection of stock for breeding likely to yield the desired results.

Nevertheless, unfortunately, certain very vexatious accidents arise which not only affect the pleasure of breeding, but which also may affect the breeder very seriously from the financial point of view. I have no intention of setting out here the numberless diseases which may affect young animals and which may arise from bad keeping and attention, e.g. damp stallage (wet ceilings and the dripping of condensed wall moisture), as well as wrong feeding of the sows and the young pigs, but rather to call attention to an altogether special pig mortality and the methods of its control; a mortality which, in spite of the best stabling arrangements, access to grassland, feeding and care, may arise; and in some cases may force the pig breeder to abandon his business.

Pigs die with every appearance of a general debility either in the first three to five days or four to five weeks after birth. The growth is often very seriously retarded and animals several months old are often hardly any bigger than those of only three to four weeks.

Post-mortem examination supplies no indication of a cause for the sickness and still less does investigation by a competent district veterinary surgeon. Further, a study of animals sent to Ruhlsdorf and Schleissheim either alive or dead has not furnished anything that can be got hold of with certainty as an explanation. We are thus helpless in face of a mortality and weakness in pigs which threaten danger to the two interests concerned.

This position was very worrying to myself as one responsible for the treatment of the diseases of domestic animals, and I experimented with ultra violet rays by the Hanovia artificial sunlight method, for the control of this mortality among pigs. Building upon the fine results obtained by Huldschinsky, the Hamburg children's physician, by the use of sunlight treatment on rachitic children, results which to-day hold an unimpeachable position in orthopædic science, and further on the reports of the American expert in the diseases of women, Donnelly, who, by ultra violet radiation obtained important results in pregnant women (as for example saving the teeth of the mother, procuring the proper functioning of the kidneys and thyroid glands, and especially of the internal secretions, the regulation of blood pressure, the avoidance of labour pains, etc. etc., improvements of the tone of the abdominal muscles, avoidance of the only too common pendulous belly after pregnancy, of flat footedness, etc., and especially in procuring the normal birth of normal children). In view of what has been accomplished in this direction, I set myself to combat the above-described mortality among pigs, which threatens the industry,

by the use of ultra violet rays. The experiments were arranged in order to establish in the first place :—

(1) Whether it was, above all, technically possible to carry out such radiation on practical and commercially profitable lines.

(2) Whether it was possible to obtain a general effect on the sows and the young pigs, and especially an effect free from objections.

(3) Whether the mysterious mortality among sucking pigs could be controlled and the growth of the young animals promoted.

(4) What was the best method of radiation and what seemed to be the best animals to submit to it.

In the following pages the whole of the experiments made from this point of view and the results obtained in both styes are set out.

In order to make the story more easy to understand it is perhaps desirable first to set out the most important points as to the light itself.

Without sun and light there can be no life. Man in his savage state grasped this fact and put it on record by the worship of the sun. The modern biologist studies under the microscope the effect of light on the cell in the plant and animal world, and realises the enormous importance of rays of light to the plant cells for the building up of their chemical structure and changes and knows that the same thing occurs in the human subject. Those who are hidden from the beneficent influence of the sun are far more liable to all kinds of diseases than those who are brought up in full sunlight.

The most practical example at the present time that medicine affords us is the fact that, formerly anæmic girls were exceedingly common. As the years went by women's fashions became more and more sensible in many respects and the body was far more exposed to light, with the result that chlorosis is now almost unknown, and the high school teacher is now worried if such a case arises.

The light as is well known is not in itself a unity, but a combination of various kinds of light, as everyone knows who sees the rainbow. Beyond the colours made obvious to us by the rainbow (or produced artificially by glass prisms), i.e. red, orange, yellow, green, blue, indigo and violet, there are other rays which our eyes are incapable of appreciating, and which lie beyond the visible violet and red. These are known as ultra violet and ultra red rays.

For our present purpose only the ultra violet rays are of consequence ; these form part of sunlight, but are so far absorbed and cut off by dust, water vapour, and other conditions in the upper strata of the atmosphere that they are only met with in considerable amount on high mountains and in dust-free, open areas of high land. This state of things has resulted in the placing of sanatoria on high

mountains, and the driving of the domestic cattle to the hills, in Bavaria and Switzerland.

Finsen in 1893, in his classical treatise on Lupus, pointed out the healing qualities of the ultra violet rays which he produced by means of a carbon arc lamp. After him a pressing need arose for independence of the sun as a source, and the discovery of sources, of light, which should be at all times and whenever required, at the service of the hygienist. Thus, there came into being, as artificial sources of ultra violet rays, the Reyn lamp, the iron lamp, the Uviol lamp and the water-cooled quartz lamp (Kromayer lamp). My experiments were made with the air-cooled quartz lamp, " Artificial Sunlight," originally the Hanovia. This lamp is preferable to all others in its construction, especially as regards risk of danger from fire and the limitation of movement in lamps fitted with carbon pencils. It will be well here to give a brief description of this lamp.

The mercury vapour lamp is covered by an hemispherical cap, and the burner consists of an exhausted light tube of quartz, which is slightly bent down on both sides and contains mercury. At the bent ends are the poles and the fan-shaped cooling arrangement. The burner can be tilted on its long axis and so permits the mercury to flow from one pole to the other. By this the circuit is momentarily completed and when the burner is brought back again to its original position of rest the thread of the metallic current bridge breaks and the resulting mercury vapour replaces it. The lamp then burns with a bluish-white light and reaches its greatest intensity in about 10 minutes.

The light so produced is exceedingly rich in ultra violet rays, and compared with the sunlight and the carbon arc lamp is greatly superior in consequence of its greater richness in short wave rays. It differs so much from sunlight in that it provides a very important condition in an artificial source of light in that not only does the light come very near to sunlight in *quality*, but surpasses it in *quantity* considerably ; though the artificial source of light is not capable of too long radiation to produce biological action. With this preface we may proceed to deal with the first of the questions set out :—

" *Is it at all technically possible, practical and a commercially paying proposition to make use of ultra violet radiation in pig styes ?* "

The answer to this first question caused many experiments to be made in order to make it clear that the animals, as such, under ultra violet radiation suffered no harm. This seemed therefore a very important matter to be settled, as it is known that men, and also dogs, may suffer acutely from inflammation of the eyes under ultra violet radiation.

After about two years of experiments I am able to say that such

eye injury was never observed either in the sows or in the sucking pigs. It must here be carefully noted that the radiations were of from 30 to 60 minutes duration and at distances of from 60 to 120 cm., and that no sort of restlessness or other manifestation was observed nor any irritation of the eyes causing them to be closed. Animals that were troubled with lice rubbed themselves quite naturally with or without radiation, even in the softest sunlight, and none of these acts can be set down to radiation.

Had the sucking pigs and the sows been sensitive as to their eyes, the treatment with ultra violet rays could not have been carried out. The difficulties of fitting the animals with masks may easily be imagined and how quickly they would have been torn off and the amount of time and labour required, to say nothing of the daily exhausting upset of the animals caused by the operation. All these points require attention, otherwise the carrying out of the radiation would have been the subject of insurmountable difficulties.

The second part of the question was sought to be settled by arranging the artificial full sunlight in the fashion of a suspension railway, so that it would be drawn on a rope over the various stalls, and directed upon any such, of any kind, very quickly and suddenly.

An arrangement for regulating the distance of the lamp from the object to be radiated completed this cheap and practical device. *An important point is that it rules out any special skill, as the radiation of the various irregularities can be looked after and without delay by any sty tender while attending to other work in the sty.*

The first question can therefore be answered in that it is possible to set up in a pig sty an arrangement for artificial ultra violet radiation which *raises neither technical nor economic difficulties and needs only the simple watching of a lamp consuming about three-quarters of a kilowatt per hour. The apparatus itself is portable.*

The second question, as to whether any effect on the sow and sucking pigs after artificial sunlight is at all observable can be answered in the affirmative.

In order to obtain a clear picture, I have radiated the different animals under, as far as possible, similar conditions and have compared them with corresponding non-radiated groups. Further, I have compared the earlier litters of the sows with the later radiated ones.

We must now describe the separate experimental groups in detail.

Group I.

Sow No. 27.—Pedigree provincial pig; born in 1925, had a second litter of seven on March 24th, 1927, and in the previous year

her first litter of six, of which three died, i.e. 50 per cent. Of the second litter a feeble pig was overlaid by the mother eight days after birth.

This experimental animal was radiated eight days before parturition, three or four times and, seven or eight weeks after, radiated together with the sucking pigs. The six little pigs throve very well and better than the first litter (statement by the owner 3). Five pigs (one had been sold) gave on May 22nd, 1927 a total weight of 141 pfd., i.e. 28·2 pfd. per pig (21 pfd. equals $\frac{1}{2}$ kilog $1\frac{1}{2}$ lb. Eng.). While in the previous year half the litter died, in this year there was only one feeble subject lost, and this was overlaid. The remaining six pigs throve visibly under the action of the quartz lamp.

Note.—Careful distinction must be made between *died* from natural causes and overlaid.

Group II.

Sow No. 8.—Berkshire; born 1924, had a third litter of eight on March 20th, 1927, all living and developing exceedingly well. Out of the second litter of nine one died and two were overlaid. Out of the first litter of nine two died. Radiation was begun eight days before parturition. On May 22nd, 1927, the average weight of a sucking pig was 35·1 pfd. In the experiment the extraordinary milk-giving capacity of the sow failed, and the proper nourishment of her young depending on it fell off as a result. This group was therefore specially radiated, as this sow had been earlier in her life a pet of the owner.

All the pigs of the third litter got on well, and this, in comparison with the earlier litters can only be put down to the use of the quartz lamp.

Group III.

Sow No. 29.—Cross between a Berkshire and a provincial pedigree pig; born 1925, first litter of nine on March 25th, 1927, of which one died eight days after birth. It was feeble from the first.

Radiation carried out 14 days before parturition.

Parturition, which was regarded as having gone on well from the beginning, took place properly under the ultra violet rays of the quartz lamp. On May 22nd, 1927, the average weight of the pigs was 23·6 pfd.

Group IV (Partially Radiated).

This sow was a cross between a Berkshire and a provincial pedigree pig; born June, 1925. Had a first litter of nine pigs, of which one died. The second litter (March 4th, 1927) consisted of 12 pigs, of which two were in a bad state and regarded as hopeless. Of this second litter of 12, six of the weaker, and the weakest, were chosen

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for experiment and subjected to radiation. The six stronger ones were not radiated, nor was the sow herself.

On April 3rd, 1927, the average weight of a radiated pig was 6·16 pfd. and the non-radiated 6·83 pfd.

On May 22nd, 1927, the average weight of a radiated pig was 32·5 pfd. and of a non-radiated 41·3 pfd.

These figures do not appear to be specially favourable to the quartz lamp treatment, but it must be taken into consideration that the two very feeble pigs were included and that the stronger animals were hearty feeders of themselves and especially in the matter of extra food, so that the results are hardly satisfactory. The difference, however, in those pigs when the sow was radiated at the same time is striking. This experiment clearly showed how great is the influence of the anti-rachitic, vitamin-rich milk of the mother on the sucking pigs.

Group V (Not Radiated).

(To be Compared with Group II.)

Sow, provincial pedigree, in size and weight like Sow No. 8; born February, 1925. Has had two litters. Second litter of 11 (March 20th, 1927), of which two were overlaid and two died.

Soon after birth the three strongest of the pigs were given a foster mother so as to spare the mother of the remaining eight. One was overlain by its own mother and of the other three two were overlain by the foster mother and one died. The average weight of the surviving seven pigs was 33 pfd. The growth of the animals was on the whole good.

Group VI (Not Radiated).

(Compare Group VII.)

Sow, cross between Berkshire and provincial pedigree pig. First litter of eight pigs, of which one overlain. Second litter, May 16th, 1927, of ten pigs. The weight of these pigs eight days after birth averaged 43 pfd., or 4·3 pfd. per pig.

Group VII (Radiated).

Sow, pedigree provincial of the same size and age as that of Group VI; this sow was heavily radiated every day for five consecutive weeks. The first litter of 1926 was of nine pigs, of which three died. The second litter was of 10 pigs on May 16th, 1927, all living up to October 7th, 1927 without loss.

The pigs were exceptionally well made and well nourished animals when they were born. Eight days after birth the total weight of the litter of 10 pigs was 73 pfd., or an average of 7·3 pfd. per pig. The further growth of these pigs can only be described as excellent. At eight weeks old two of them were sold at a total weight of 100 pfd.

Group VIII.

Six to seven of the doubtful ones were radiated until the death of one of them.

Group IX.

Two doubtful ones out of four radiated ; of these one died.

Criticism of the Individual Results.

If we go through the groups one by one we find that in Group I, out of the first litter one-half died as the result of the indefinable sucking pig mortality, while, in the second litter there was no deaths from this cause. In this latter case we must conclude that the sucking pigs in consequence of them having the milk of a radiated mother, and also in consequence of their being radiated themselves, were beneficially influenced. It cannot be doubted that the milk produced was rich in vitamin-active and anti-rachitic elements, and that this specially increased the powers of resistance of the young pigs. The good general condition of the sucking pigs could be readily gathered from the faultless condition of the skin, the perfection of the nutrition and the comfortable repose of the animals. Further, the mother animal showed herself at the end of the lactation period to be hardly affected, and her general condition was very good in comparison with that after her first litter.

In Group II the radiation had straightway a strikingly good effect. While of her first litter more than 20 per cent. died of the sucking pig disease, in this case there were no deaths. Further, it is to be remarked that a sucking pig weight of 35·1 pfd. in 62 days is something well worth notice. The control animal of this group was that of Group V.

In Group V the seven sucking pigs which were left had the full benefit of the whole of the milk that the mother could supply. They throve well and after 62 days had reached an average weight of 33 pfd., that is to say, 2·1 pfd. less per sucking pig than in the case of those which were radiated. The conclusion may be drawn that both groups, under similar food and stallage conditions, with seven instead of 11 sucking pigs on the one side and eight on the other to be compared, the good effect of the radiation on growth, external appearance, and body weight, must be fully recognised.

Group III.—We have here to deal with a relatively feebler litter, which, however, improved rapidly and visibly. The little pigs grew throughly well.

Group IV.—This group makes an interesting picture. A distinction has to be made in order to form an opinion as to whether the radiation of the sucking pigs alone did as much good as the radiation of mother

and young together. At first sight the comparison of the figures may seem rather surprising when the weight of the radiated pigs is set against that of the non-radiated.

It must not be forgotten, however, that two really very feeble animals are included, and that the four others also investigated were the smaller and that the activated mother's milk reached them. Thus, we may rest content with the fact that there was no loss and that even the weaklings visibly held their own.

There is one thing to be learned from these groups for experiment, and that is that radiation of the sucking pigs without their mother does not act so completely as a general radiation of the sucking pigs and the mother at the same time.

These investigations were supplemented further by eight more made on two styes; while the first series fell in the period March to August the others took place in the cooler months, September to January.

Here again the same results were obtained as before, the only difference being that the gravid sows were radiated six to eight weeks before farrowing. The parturition was very rapid in comparison with non-radiated sows—e.g. the radiated animals completed the process in 20 minutes to four hours, while the non-radiated sows took four to 16 hours (? 16).

The answer to the third question as to whether the mysterious mortality among sucking pigs was stayed, and the growth of the young animals promoted, has already been given more or less in the detailed statements and the criticism of the second question. Here it is only necessary to repeat that, under every expectation, the mortality among young pigs which hitherto has defied control, can be combated, with but few exceptions, in both cases. The goal sought has thus been actually reached.

The fourth question: What are the methods and what animals are best suited for radiation, may be answered as follows:—The dose of ultra violet rays comprises two factors, first the duration and secondly the distance of the lamp from the radiated object; after something like two years of practice, I regard the following as suitable:

No.	Irradiation.	Time. Minutes.	Distance. Centimetres.
1	1 Day.	5	120
2	3 Days.	5	100
3	5 ,,	10	100
4	7 ,,	10	100
5	9 ,,	15	100

No.	Irradiation.	Time. Minutes.	Distance. Centimetres.
6-13	From 2 weeks daily.	15	100
14	3 Weeks.	30	100
Etc.	4 ,,	30	80
	5 ,,	30	80
	6 ,,	60	130
	7 ,,	60	120
	8-10 ,,	60	120

From the first to the second week the further radiation may go on automatically; that is to say, the man in charge of the feeding or the sty-keeper pushes the lamp horizontally every quarter or half hour from one stall to another. This duty involves no increase of trouble and ensures a regulated radiation.

As far as the animals are concerned, I have found, as has been set out for the various experimental groups and from further researches, that it is best and should be made a rule, to radiate the gravid sows eight weeks before farrowing, and both sow and pigs together for eight weeks after birth. Radiation of the sow only, or of the sucking pigs only, does not lead so well to the desired result, though it cannot be denied that the effect is good. The radiation of pigs suffering from the swine fever virus is useless.

The same is true of the so-called "wasters." The treatment of these (feeble) animals requires time and labour, and the result is only disappointment, which may reflect discredit on the otherwise good results of artificial alpine sunlight. No doubt it is useful also to radiate the boar. The paper would not be complete if I did not deal with the housing, maintenance and feeding of the pigs experimented upon.

The experimental animals were, in both cases, brought up in styes of modern construction, in which all care was taken to secure freedom from damp, warmth, light and air as fully as possible. In addition to this the animals were free to run about and had access to grass land so far as the farrowing permitted.

The food details relating to Groups I, II, III, IV, V, VI, VIII, IX and VII will now be given in order to show how carefully they were fed and at the same time with the maximum of economy (without milk) and on what diet the weights above given were obtained.

Group VII.

Food of the sucking sows (before May 6th, 1927)—

10 pfd. beet (or turnips).

5 pfd. of a thick, raw, cold mash containing coarse oatmeal,

35 per cent.; barley meal, 40 per cent.; rye bran, 10 per cent.; dry yeast, 10 per cent.; fish meal, 5 per cent., with traces of calcium chloride added.

The drink consisted of cold water. After May 6th, 1927, they were given red clover, as much as they would eat, and 2 pfd. concentrated food mixture.

Food of the young pigs from three weeks on—

(1) Dry Food—

Fine crushed barley	80 per cent.
Coarse maize meal	15 ,,
Dry yeast	2·5 ,,
Fish meal	2·5 ,,

(2) Wet Food—stirred to a thick porridge, cold—

Barley meal	60 per cent.
Maize meal	15 ,,
Linseed meal	5 ,,
Bone meal	5 ,,
Dry yeast	7 ,,
Fish meal	8 ,,

Note.—For three weeks before farrowing the sows had the better food set out above. Previously they had fodder-beet, maize, hay as an extra, and cold water. The styes were of modern construction with grass runs for the pigs adjacent.

Food for Group VII.

Four weeks before farrowing the sow had every day soaked concentrated food as under:—

Bran	30 per cent.
Feeding meal	30 ,,
Barley meal...	30 ,,
Fish meal	10 ,,
Potatoes	2 kilogs (=4½ lb.)

This food was continued until five days after farrowing, and from this time on this quantity was slowly raised to three times the quantity. After farrowing a certain amount of separated milk was given (two to three litres daily).

In summer green food was given in addition.

Feeding of the Young Pigs.

From 14 days old up to four weeks: Dry food, consisting of wheat and barley meal. From the fourth week on they had the food supplied to the sow and a liberal allowance of separated milk.

Summary and Conclusions.

From the details given of nearly two years' observation for the purpose of testing the results of radiating sucking pigs, etc., with the quartz lamp " Artificial alpine sunlight," Hanovia model, can now be given.

(1) In cases of sucking pig mortality, but neither of the infectious type nor resulting from bad hygienic conditions, ultra violet radiation is most strongly indicated. In my own cases of sucking pig mortality with no obvious cause this could be almost completely combated.

(2) The radiation of gravid sows and later, the radiation of both sow and sucking pigs together, for the given periods and distances from the lamp, is unquestionably to be preferred to individual radiation.

(3) The radiation of animals suspected of swine fever and of the so-called " wasters " is useless and to be avoided.

(4) The growth and thriving of the sucking pigs is satisfactory, though of course it goes without saying that they must be properly fed. Radiation and a faulty dietary or a short diet are contrary to reason and defeat their own ends utterly.

(5) The pig raiser has, by the use of the " artificial alpine sunlight " a means to hand, at any time of year, of providing for his stock the indispensable light energy and so of pushing his stock on. This is especially valuable in districts where cloudy and rainy weather is common.

(6) The pig raiser is also in a position to hasten the date of farrowing.

(7) In cases in which, in spite of previous radiation, the sucking pigs are feeble they pick up quickly.

(8) Contrary to the reports of American obstetricians, miscarriages in sows cannot be avoided.

(9) In spite of radiation and in comparison with the time beforehand at which it was carried out, 0·5 to 2 per cent. of " wasters " are produced, i.e. animals which are thrust aside by the stronger ones and are, therefore, so to speak, mechanically deprived of nourishment.

(10) The prime cost, and the cost of working and maintenance of the quartz lamp, artificial alpine sun, considering the resulting profit from the saving of pigs which would otherwise be lost, is easily recovered. The lamps will generally pay for themselves in the first year of their use. Attendance and special care do not enter into the question, so that they are no extra burden on private industry.

The general results of the treatment to date with ultra violet light are such as to demand urgently of all breeders of animals that they should ensure the use of this powerful, effective agent in their work, and once they are acquainted with the facts to make practical use of them.

"RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF POISONOUS PLANTS IN THE DOMESTIC ANIMALS."*

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I HAVE chosen as the title of my address, " Recent Contributions to our Knowledge of Plant Poisoning in the Domestic Animals." The title is an ambitious one, but I shall try to present to you as briefly and as clearly as possible the interesting and important advances that have been made in this field of veterinary toxicology during the past ten years.

In a continent like Africa, where the flora is so rich and varied, the subject is a most important one, especially in the pastoral districts, but our present knowledge can only be classed as meagre. Nevertheless, we are collecting information and data at an astonishing rate, and we shall soon be in a position to publish a monograph on the subject.

Up to 1926 the subject was treated in a casual manner, but two recent outbreaks of plant poisoning in this Colony awoke the authorities to the seriousness of the question, and as a result feeding tests are carried out as a routine at the laboratory on material submitted by farmers and others.

In Southern Africa Theiler and his co-workers realised from a very early date that in every outbreak of an unknown disease on a farm plant poisoning should be considered as a possible etiological factor. This attitude is now being adopted in Kenya, and in every field investigation undertaken at the present time plant poisoning must be considered as a possible responsible factor.

Unfortunately, the literature on the subject is very scattered, but Pammel, of the Iowa Agricultural College, has published a text book of two volumes on the subject, which may be taken as the most authoritative and up-to-date manual. In both U.S.A. and Australia considerable attention is paid by the various Government Agricultural journals to the subject, for the authorities fully realise the enormous damage done to livestock by vegetable poisons. In Montana and Colorado over 200,000,000 dollars damage is done to the stock industry by plant poisons every year.

At the 5th Pan African Veterinary Congress, held in Nairobi in 1923, veterinary delegates from all parts of Africa and Madagascar publicly stated that the loss of cattle every year from plant poisoning in this Continent was immense. It has been estimated by a reliable

* Address to Kenya Branch of British Medical Association, 9th May, 1928.

authority that plant poisoning does more harm annually to the live-stock industry of every country in the world than any known infectious or contagious disease, *including*, of course, tuberculosis.

Plant poisoning occurs in the domestic animals under the following conditions, viz. :—

(*a*) When animals are introduced into a pasturage the vegetation of which they are not familiar.—Herbivorous animals are naturally careful feeders and seem to possess selective instinct for knowing what to eat and what to avoid. Cases of poisoning most frequently occur in animals imported from abroad or from a neighbouring pastoral area where the nature of the grazing is different. As Curson suggests in South Africa acclimatisation involves not only the acquiring of immunity to local diseases but also discrimination regarding herbage.

(*b*) Scarcity of grazing, especially of a succulent nature.—This occurs obviously before the long rains or in the times of prolonged drought when the grazing is at its worst and animals are forced to feed off trees, shrubs or herbs which they in more normal seasonal conditions would not touch. Such is exemplified by cattle eating the numerous veld "lilies" or "tulips" which spring through the parched veld before the rains when there is a scarcity of grass.

(*c*) Accidental consumption of poisonous plants occurs mainly in stabled animals fed with lucerne or hay. This type of poisoning is not uncommon, especially when care is not given to the flora of the locality from which the fodder is cut. Material used for bedding purposes may prove poisonous, e.g. bracken.

Under usual conditions, when grass is plentiful, it is very difficult to get animals to eat non-graminaceous plants, even if, as under laboratory conditions, they are purposely starved. Some plants may be so objectionable that animals will not eat them under any conditions whatsoever, so that drenching or dosing with plant infusions, admittedly a very unsatisfactory procedure, has to be resorted to.

In connection with plant poisoning it is well to remember that plants themselves may be innocuous, but that they may be infected with some parasite or fungus which may have fatal effects when digested. The recent paper on "Ergot Poisoning amongst Rye Bread Consumers," by Drs. Robertson and Ashby, of Manchester, is of very great interest because, amongst other warning, it shows that ergotism is not a pathological condition of the past as is generally taught. In Natal it has been found that cattle fed on either (*a*) maize infected with *Diploidia Zea*, or (*b*) *Paspalum dilatum*—a common but highly nutritious grass—infected with a species of ergot, *Claviceps paspali*, showing alarming and even fatal symptoms.

Feeding with *Diploidia Zea* caused symptoms of inco-ordination and

paralysis, but the condition is not serious if a change of food is enforced and further supplies of the fungus is not given. Feeding with ergotised *Paspalum dilatum* leads to chronic ergotism, the symptoms of which are muscular tremors and hypersensitiveness followed by incoordination of movement, lack of tone of the leg muscles, anorexia and constipation. These symptoms appeared after feeding with 9 lb.–12 lb. of infected grass heads.

This particular type of ergot did not produce the sloughing or dry gangrene of the extremities which is so characteristic of the ergot of Rye, *Calviceps purpurea*. It may be stated that medicinal treatment was not found particularly beneficial for either *Diploidia Zea* or *Claviceps paspali*. Mere change of food was found to be the best treatment, and this was also the experience of Drs. Robertson and Ashby in the recent Manchester outbreak.

The Government mycologist has informed me that it is not known of either if these fungi occur in Kenya though the *cecelia* stage of a species of ergot has been observed in Tanganyika. We apparently know very little about the prevalence of these important substances in this Colony.

I now wish to refer to some recent and important work that has recently been done in connection with the *gramineæ*. It is generally stated in text-books of toxicology that only three grasses are known to be poisonous, e.g. *Setaria sulcata*, *Sorghum Sudanese* (Sudan grass), and darnel (*lelium temulentum*). In *setaria sulcata* and darnel the seeds only are poisonous, the former, as far as is known at present for birds, and the latter for man and all herbivorous animals.

Sorghum owes its poisonous properties to a cyanogenetic glucoside which is readily converted into hydrocyanic acid by enzyme action. Darnel poisoning has not been recorded from this Colony, but it exists in South Africa and other wheat growing countries. Symptoms of poisoning by this grass are small, and slow pulse, coldness of body surface and extremities, convulsive movements of head and limbs, rapid enfeeblement and death in 36–48 hours. On *post-mortem* more or less slight intestinal irritation may be the only symptom noticed. Sorghum poisoning is probably quite common, as in times of drought, when cattle are frequently fed with the stalk and leaves of the plant. It has been recognised in the Sudan and in other parts of Africa, but as far as I am aware no authentic case has been described in this Colony.

Recent work in America, and Bechuanaland, South Africa, has shown that many of the *gramineæ* may, under certain conditions, become markedly poisonous for herbivorous animals on account of the formation of excessive quantities of hydrocyanic acid. Swanson

and Henrici have shown that sorghym and andropogon produce H.C.N. on wilting. This acid causes grave symptoms and even death in cattle, and to a less extent in horses.

So great may be the amount of acid produced that it may be detected by its characteristic odour of bitter almonds in an aqueous extract of the grass. Generally, however, it can only be demonstrated, even in very minute quantities, by the picrate test which is always put into operation during a field investigation.

The discovery that many excellent fodder grasses may be excessively poisonous under certain conditions is very important for the stock breeders.

These grasses, their name is legion, when fresh, are free from even minute traces of prussic acid, but when they are wilting or drying before the rains or even after the rains if conditions are such as to cause wilting, e.g., heavy winds after a shower under a blazing sun, the formation of acid is very rapid.

Under these conditions H.C.N. may be demonstrated by the picrate test. Henrici found that grasses which have a reddish purple coloured stem during drought periods possess very little or no cyanogenetic substances, and those whose stem is normal colour form a high percentage of hydrocyanic acid. This so-called colour index may prove useful in examining pasturage for grasses likely to be source of poisoning. It is important to add, however, that wilted grasses swollen out by rain lose their cyanogenetic substances in a few hours. Although hydrocyanic acid poisoning from wilted grasses has not yet been diagnosed in Kenya I am very certain that it does occur and may possibly be one of the explanations of these rapid and sudden deaths which occur on farms throughout the country at the end of the long drought period before the heavy rains. It is important to remember that most of the grasses used by Henrici in Bechuanaland are found throughout Central Africa, and as climatic and telluric conditions are very similar in both Bechuanaland and this part of Africa it seems feasible to believe that it is only a question of time before we can blame hydrocyanic acid poisoning for these sudden cases of death without any visible pathological changes for which, at the present time, we can advance no satisfactory explanation.

What has been said in connection with grasses is also known to hold with many wild veld plants. Thus, *Dimorphotheca spectabilis*—a wild veld *compositæ*—is only poisonous under wilting caused by a hot sun and a drying wind.

The investigations of Sir Arnold Theiler on the disease of sheep known as "yellow thick head," are classical. For nearly 10 years Theiler was unable to prove the cause of this disease. He was certain

it was a poisonous plant, but feeding experiments with all the plants found on that part of the farm where deaths occurred failed in every instance to reproduce the disease. At last positive cases were obtained, and it was found that a certain plant—*Tribulus terrestris*—was very toxic for sheep while it was growing luxuriantly before the formation of the seeds during hot weather after rain. Thus, this plant was only toxic for a very brief period in its life history, but it was at this time capable of causing a very heavy mortality which had every appearance of being due to a highly infectious disease. This plant occurs in Kenya, but up to the present time we have no record of its toxicity. It is remarkable that feeding tests carried out in Australia with this plant have always failed. Possibly the exact stage in which it was found poisonous by Theiler was not experimented with.

While there is thus a seasonal variation in the toxicity of certain plants it is also well recognised that telluric conditions are important, for certain plants are particularly toxic when grown on certain soils and in certain situations.

Plant poisoning may be acute or chronic. The former is generally easily recognised, but if numerous deaths occur more or less simultaneously the analogy with some acute infectious disease may be very striking and cause confusion. Thus poisoning by the wild "tulps" or "tulips" simulates both in its clinical symptoms and morbid anatomy acute rinderpest, and blood inoculations may have to be resorted to finally clear up the position.

It is very interesting that many types of plant poisoning occur in certain districts where certain diseases happen to be endemic. Thus in Zululand Curson noticed that poisoning by *Acokanthera* occurred in the same districts as heartwater. Both these conditions produce remarkably similar symptoms, making a differential diagnosis most difficult in absence of blood inoculations which would, of course, finally decide the question. I have been able to confirm Curson's observation in a recent outbreak amongst cattle on a farm in the Ngong forest. The symptoms were classical of heartwater, but the disease was not produced by blood inoculations from sick beasts into healthy susceptible animals. Eventually the mortality, amounting to 25 head of cattle, was proved to be due to poisoning by *Acokanthera schimperi*, a tree with damson-like fruit and dark green glabrous leaves.

I now wish to draw your attention to a few very important discoveries that have recently been made by Theiler in connection with chronic plant poisoning.

During the investigations into acute liver atrophy and parenchymatous hepatitis in horses Theiler observed that the plant *Senecio*

latifolius was capable of producing the latter condition experimentally. But the most important fact discovered was the appearance of a long period of incubation between cessation of feeding of the plant and the onset of clinical symptoms. In one case this period was as long as 96 days, but generally the period varied between 20–43 days. This long period of incubation, or latent period, indicated, in Theiler's own opinion, either that the poison of this plant was cumulative or else it was fixed in the liver and produced its action slowly and gradually but leading up to a decisive and inevitable lesion.

About the same time as the above investigation Theiler proved the plant *Tribulus terrestris* to be the cause of the sheep disease known as "yellow thick head." The peculiar climatic conditions under which this disease appears have been mentioned above, but the most noteworthy fact derived from Theiler's experimental work was that of the occurrence of a temperature reaction in the course of the evolution of the disease. It was often the first symptom of illness noted, and lasted for a period varying from a week to 10 days. The behaviour of this febrile reaction was similar to that of any ordinary infectious disease.

Theiler was quite unable to furnish any explanation for this phenomena, and showed that the plant, autoclaved to sterilise any extraneous organisms on it, was equally able to cause the fever. Thus it was quite clear that some intrinsic agent was responsible for the temperature produced at the onset of the disease.

A few years later Theiler investigated a fatal disease of horses known as "jagsiekte." He soon found the cause to be a plant, *Crotolaria dura*. Two important observations were made by him during his experiments, namely (*a*) that symptoms of the disease may occur from 16 to 80 days after the plant had been fed with an average of 50 days, and (*b*) that during the period the plant was being fed there was a mild febrile reaction. The fever appeared at once if large quantities of the plant were fed, and about 8–10 days later if small doses were taken. In both cases the fever lasted the same length of time, and appeared both in animals fed on autoclaved and normal plant. The average amount of plant required to produce disease was 23 lbs.

It will thus be seen that in *Crotolariosis equorum* there is a combination of the phenomena which are individually observed in poisoning by *Tribulus* and *Senecio* respectively, but until further biochemical and pharmocological research is gone into the active principles of these three plants in a pure state it is not possible to explain, even theoretically, these very important and interesting observations.

I would like to mention that both cattle and horses are susceptible

to poisoning by *Senecio latifolius*. Whereas the latter suffer from a chronic parenchymatous hepatitis and an interstitial myocarditis, symptoms appear earlier in cattle, and in them are of the nature of a gastro-intestinal catarrh. Whether the same active principle causes the lesions in both cattle and horses, or whether they are produced by different alkaloids, must remain unsettled until more exhaustive work has been carried out with the alkaloids individually and combined. There are two poisonous alkaloids in *Senecio latifolius*, namely, *Senecifoline* and *Senecifolidine*. Cushny holds the latter—*Senecifolidine*—to be responsible for causing hepatic cirrhosis in animals, a statement now considered to be erroneous in view of the more recent work of Theiler in which, as we have seen, the liver lesion is a hepatitis and not a cirrhosis.

In conclusion I just wish to describe what has been done at the Kabete Laboratory on poisonous plants during the last 12 months. Some dozen plants have been fed to sheep with varying but generally negative results. It is out of place to describe these plants here, but in feeding tests it will be recognised that negative results give quite as much information as positive results. It is hoped to publish the names of these plants in some local journal shortly.

Detailed investigations were carried out into two very serious outbreaks of poisoning at Ngong and Molo. In the former case 25 cattle perished in a few days, while at Molo about 47 cattle died within a space of 24 hours.

The history in both cases was very similar. Grazing was so very poor that cattle lost all sense of discrimination and began to eat forest vegetation. At Ngong portions of two trees, namely, *Acokanthera schimperi* and *Acokanthera longiflora* were eaten. Poisoning was very rapid and in cases death was so sudden that anthrax was suspected. Very few symptoms were observed, but they were those of an acute gastro-enteritis with profuse diarrhœa. On *post-mortem* the whole alimentary canal was violently inflamed, while there was an acute œdema of the lungs. Portions of both trees were found in large quantities in the stomach, and allowed of a provisional diagnosis until feeding tests were carried out with further portions of the trees. These tests resulted in the deaths of four sheep and one goat in times varying from 17 minutes to 21 hours with symptoms of acute gastro-enteritis, great prostration and acute pulmonary œdema. It is fairly well known, of course, that these *Acokanthera* trees are deadly poisonous, for from them the famous Dorobe arrow poison is prepared.

The Molo outbreak was not so easily solved. A herd of virgin heifers wandered off their usual grazing into the adjacent Mau forest, and eventually reached the dried up bed of a stream, on one side of

which was a fairly full streamlet. The trek to the stream began late in the afternoon, and at sunrise on the following morning 47 animals lay dead either on the bed of the stream or in the adjacent forest. Prior to this outbreak the herd was perfectly healthy, and no deaths occurred after the animals were removed to their former pasturage and isolated there. Anthrax was easily excluded, but unfortunately no *post-mortems* were performed, as the farmer believed the disease to be infectious and preferred not to open the carcasses. By the time I arrived at the farm, two days later, all the carcasses had been burnt, so that one valuable step in the investigation was entirely lost. A comparison was made of the flora of this river bed with that of others where cattle always graze and water with impunity, with the result that one plant was picked out of the river bed where the fatality occurred and feeding tests with it were immediately begun on the farm and continued at Kabete.

The results were startling, for all the experimental animals died within 12–18 hours. Further experiments with the plant confirmed its very great toxicity. Two ounces of it were toxic for sheep and goats and about 8–12 ozs. for cattle. The root and stems were particularly poisonous.

The plant is a typical *Umbelliferæ*, but as I could not get specimens in flower or fruit at the time of investigation I am unable to give its name at present. However, flowering specimens have been recently obtained and sent to the Pretoria herbarium for identification.

I have experimented with a few plants which have been sent on to me by the authorities at the Scott Laboratory with the history that they were used for murder purposes by natives. In particular I investigated an Adenia which was received from the D.C. of Meru. The powdered root of this plant was said to have been used by a Meru poisoner with success as he got rid of several rivals. Feeding a sheep with the dried powdered root I caused death in 24 hours with all the symptoms of acute gastro-enteritis. I may add that accidental ingestion of the fresh root of this plant by some white labourers on the South African Railways caused death from gastro-enteritis. The root was mistaken for a wild edible turnip and careful feeding experiments carried out by Green and Andrews proved the great toxicity of the plant which belongs to the family *Passifloraceæ* (passion flower family).

In conjunction with the Professor of Pharmacology of the Medical School of the University of Witwatersrand, South Africa, I am collecting as much information as possible on native medicines, and I would be deeply obliged if Medical Officers could give me any assistance in collecting data and specimens concerning the native medicines and poisons of this Colony. Due recognition will be given for any help received.

XUM

OBSERVATIONS ON CALCIUM DEFICIENCY AS A CAUSE OF CERTAIN DISEASES OF ANIMALS AND MAN.*

By C. E. CORLETTE, M.D., Ch.M., D.P.H.,

Senior Surgeon to the Sydney Hospital; Lecturer in Clinical Surgery, University of Sydney.

(*Concluded.*)

Ergotism.

Ergotism is described in veterinary literature as liable to affect animals under certain conditions. In this connection ergot is often used as a generic term to include other fungous growths on grasses, believed to be more or less similarly harmful. It is said to cause nervous symptoms (inco-ordination, spasms, paralysis), sores in the mouth, about the feet or elsewhere, loosening of the hoof, gangrene of ears, tail, or feet, and abortion. I can believe that ergot is poisonous, but there is, to my mind, good reason for being extremely sceptical about the diagnosis of these morbid manifestations as due to ergot or similar fungous parasites. If ergot can produce gangrene and the other symptoms, experimental feeding with ergot has been extremely unsuccessful in proving it without fallacy, or even in getting any results at all. And most animals will not voluntarily eat ergotised rye; they seem to prefer starvation.

Law[50] in his great veterinary textbook says that:—

> Towards the end of our long winters in the Northern States we occasionally find widespread gangrenous ergotism from eating infested hay.

But we are surprised to read a little further on that:—

> Usually ergot and smut can be safely fed in relatively large amounts with a liberal ration of potatoes, turnips, beets, green fodder or ensilage.

So it takes nearly the whole winter before the ergot takes effect, and the effect can be warded off by adding other materials without taking away the supposedly toxic material. It is much more likely that the vitamin *D* of the hay had lost its activity, and quite possible also that in many of these cases it has been a low-calcium hay. But can lack of "fat-soluble vitamin" produce all these symptoms? The answer is that it can and does do so in laboratory animals, which may exhibit stomatitis, sores about the feet, loss of cuticular structures, gangrene of toes, ears, and tail. If that nutritional weakness were reinforced by severe cold, the effect would be much more prevalent

* Reprinted from "*The Medical Journal of Australia.*" Feb. 18/28.

and much more severe. These animals, supposed to be ergotised, were in precisely the same case as Steenbock and Hart's goat.[1]

Gilruth[51] records that cattle, sheep, and horses, pasturing in the Hawke's Bay and some other districts in New Zealand, are very subject to nervous symptoms in late summer and autumn. This was noticed especially, or solely, in pasture mainly composed of seeding rye-grass. The animals exhibited muscular supersensibility (spasmophilia ?), and inco-ordination. It was popularly attributed to ergot, but Gilruth seemed rather doubtful. I would point to the fact that rye-grass is another fodder plant that flourishes in very acid soil, and that under such circumstances it would contain very little calcium. If animals are confined to such pasture, they might suffer from deficiency, like the bone-chewing cattle on the Armoedsvlakte pasture in late summer.

A few words may be said here about ergotism in man. I have a strong suspicion that certain human epidemics that have broken out in times of famine have been homologous with the *lamziekte* of cattle, cage paralysis of monkeys, and so on. Human osteomalacia is a disease of chronic privation, but I do not mean this so much as the " convulsive " type of ergotism (*Kriebelkrankheit*), and lathyrism.

According to Hirsch,[52] epidemics of so-called ergotism have been of two kinds, the gangrenous and the convulsive. These two kinds do not occur together. I have nothing here to say of the gangrenous type, but I am bold enough to hazard the opinion that the convulsive form was tetany, due to a dietary limited to grain (rye), and not much of that, a dietary, in fact, similar to that of Weill and Mouriquand's pigeons. The spasticity of *lamziekte* animals I have already attributed to tetany.

That convulsive ergotism was accompanied, more or less, by itching, as its German name *Kriebelkrankheit*—" itching disease "—shows, causes no difficulty. It makes it rather like the Scottish " scrapie " of sheep, the " trotting disease " of sheep in Germany. But Halsted's[53] experimental studies of partial thyreoidectomy (really partial thyreoparathyreoidectomy) in dogs showed that intense itching and falling of the hair occurred in a number of his cases, together with twitchings and general convulsions. It is now well known that the blood calcium is greatly reduced after parathyreoidectomy, and that complete removal causes rapid death from tetany. Having said this, I suggest now that scrapie and trotting disease are also homologoues of *lamziekte*. This disease, or these diseases, prevail on damp, sour pasture.

A word might be said now about the " mange " that Mellanby[2] found so severe and troublesome in some of his puppies receiving

deficient diet. Is it not rather significant that Erdheim[54] found "mange" to be very troublesome in his rhachitic rats? Then let us think again of Halsted's experiments. Was the "mange" simply an accidental accompaniment, or was it a manifestation of hypocalcæmia? I suggest that it might have been, but of course it remains possible that it was one of the varieties of parasitic mange. Is it possible that some of the cases of "mange" in domestic animals are manifestations of calcium deficiency?

Lathyrism.

As to lathyrism, that is also a spastic, convulsive, and paretic condition occurring only in famine times, and attributed to the effect of a dietary confined rather closely to lathyrus peas—and those probably not in great plenty. It is well known that seeds, including peas and beans and all grains, are very low in their calcium content. A man or animal confined mainly to a diet of this kind would get relatively little calcium, and, like the so-called ergotised people, he would be in the same case as Weill and Mouriquand's pigeons.

But peas and beans of all kinds are relatively deficient in a constituent that is essential to life, namely cystine, the important sulphur-containing amino-acid. This has been shown in a long series of papers by Johns and Finks, and it has been shown by the same experimenters[55] that cystine deficiency is liable to occur in animals on bean diet, unless the beans are boiled, or unless cystine is added. Since for human use peas and beans are boiled, the danger of cystine deficiency is minimised, but it is different with animals.

The most complete description of lathyrism in recent times has been contributed by R. Stockman.[56] Stockman remarks that:—

> As very large numbers of mankind habitually eat lathyrus peas, it is certain that when they are taken as part of a mixed dietary no poisonous symptoms occur, but in times of famine or poverty, lathyrism is apt to occur.

Lathyrism is said not to occur in man or animals when the peas are only a subordinate constituent of the dietary. As a symptom of lathyrism, the horse is said to suffer from "roaring," due to paresis of the recurrent laryngeal nerve.

Stockman made a series of experiments on monkeys, rabbits, pigeons, ducks, pigs, and sheep, feeding them for a prolonged period on lathyrus peas. He produced symptoms in the monkeys, but not in the other animals. The peas were boiled or steamed, and though described as given "exclusively," it appeared that in the monkeys there was an addition of fresh raw fruit and "vegetables." As to the symptoms produced, one of the most prominent was tetany, displaying the characteristic "*accoucheur* position" of the hands.

One of the monkeys certainly died of tetany. I cannot see evidence of anything in the symptoms except indications of calcium deficiency—which they would have shown on a grain diet quite as much as they did on the peas. Stockman regarded the symptoms as lathyrism. If I am right about calcium deficiency, the symptoms were the same as those of calcium deficiency, and Stockman's conclusion that the experiments proved toxicity in the peas is founded on fallacy.

As regards the effect on animals, I cannot see in paralysis of the recurrent laryngeal nerve any more evidence of toxicity in the peas than of calcium deficiency. Sjollema[57] says rabbits become bald in cystine deficiency, and that the baldness is cured by giving cystine. Hair contains about two per cent. of cystine, so it is easy to see why deficiency should cause baldness. It is not recorded that horses lose their hair through eating lathyrus peas.

Yet perhaps cystine deficiency could be produced in animals fed on lathyrus peas instead of grain. Hart and Peterson[58] have investigated the sulphur content of various fodders. They noticed that the sulphur of straw did not disappear on ignition, but remained in the ash. But a large part of the sulphur of grain disappeared. This they interpreted as showing that the organic sulphur was practically all in the grain. The logical inference is that the cystine is in the grain, and that straw contains very little. Accordingly, an animal fed on straw and grain would depend on the grain for the necessary cystine. If the grain were replaced by peas, it is possible to see how a cystine deficiency could occur. The risk would be minimised by mixing grain with the peas. Whether this ever occurs is another matter. But what becomes of the toxic theory here?

A Concluding Warning.

I have mentioned, but perhaps not sufficiently emphasised the point that in calcium deficiency we have a panorama, a general disorder involving all functionating cells, and therefore involving the important organs of secretion, internal and otherwise. When we think of the rickets, gastro-intestinal catarrh, diarrhœa, bronchitis, and the like, we should think of them always as parts of a panorama, not all of which is clearly visible, and as representing a process going on everywhere, including the liver, the pancreas, the kidneys, the thyreoid, the parathyreoids, and so on. The function of these organs, like that of the nerves, is disordered and depressed. The glycogenic function of the liver is disturbed, and its detoxicating function more or less suspended. The animal is brought to some extent into the condition of an animal with an Eck fistula, in which the portal blood is diverted into the systemic circulation without passing through the

liver. Metabolic poisons may not be properly detoxicated. It is small wonder that grave symptoms occur.

And I would say one more word. I have reason to believe that these organs, liver, pancreas, kidney, parathyreoids, and also the nervous system, do not always recover completely when the original deficiency is removed. Some permanent damage often remains. Thus a cirrhosis of the liver in animals may be the result of a deficiency no longer existing in the dietary. Cœliac disease in children may be due to the same thing.

Summary.

Calcium and/or phosphorus deficiency can cause nervous disorder closely resembling that produced by deficiency of vitamin *B*. It is, or may be, implicated in many morbid conditions of man and animals in which nervous symptoms often occur. Amongst these are polyphagia, earth-eating (and "sand disease"), bone-chewing, coprophagia, "ergotism," "lathyrism," scrapie, or trotting disease of sheep, epizootic stringhalt, laminitis, rickets, osteomalacia, spasticity, paraplegia, tetany, milk fever and lactational dyspepsia of cattle and other animals, and the *stijfziekte* and *lamziekte* of South African cattle, and conditions answering to the same elsewhere. To these may be added some cases of supposed forage poisoning.

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A DAY'S WORK AT THE P.D.S.A. SANATORIUM.*

By a P.D.S.A. OFFICIAL.

WORK never ceases at the Sanatorium. The day is divided into three periods of eight hours each, viz., 7 a.m. to 3 p.m., 3 p.m. to 11 p.m., and from 11 p.m. to 7 a.m.; at each period there is a complete change of staff. In the summer the day's work begins at 6 a.m. with the watering and feeding of the patients. An hour later is the rule in winter. Animals which are able to be exercised are taken out to the paddocks and others put at grass. The very bad cases are kept back in their stalls. Dressings and the various treatments of patients are next carried out under the supervision of the Assistant Superintendent of the Technical Staff and the Headgroom. As the horse patients in the Sanatorium average as a rule between thirty-six and forty-two it can be readily understood that this particular work takes a considerable amount of time to accomplish. Stalls are cleaned out thoroughly and fresh bedding and straw put down.

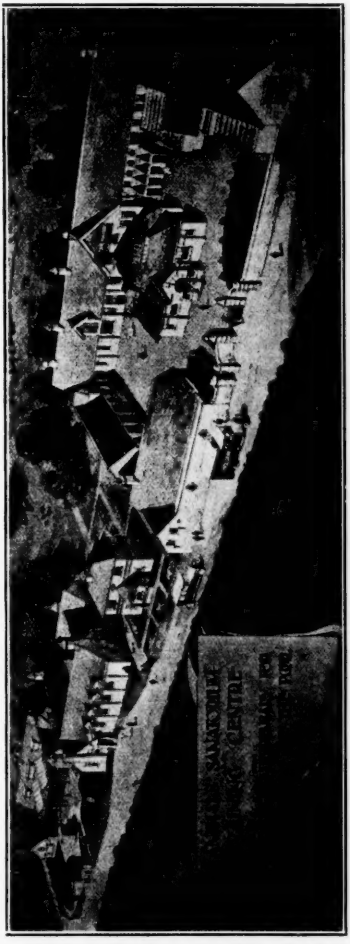

Fig. 1. The People's Dispensary for Sick Animals.

At the same time as the work above described is being carried out in the stables, much the same is going on in the Small Animals' Ward. The dogs and cats are being fed by their own staff and then their kennels cleaned and freshly bedded.

* Reference to this article which is published in *The Animals' Advocate*, September, 1928, will be found in the Editorial.

In the yard the motor ambulance drivers are busily engaged cleaning their cars and tuning up their engines, and also seeing to their interior requirements in the way of first-aid material, so as to be prepared for any emergency call, or special duty.

At 9 a.m. the nursing staff attached to the Small Animal Ward come on duty, and they begin the dressings of the patients under their charge and the Senior Assistant performs minor operations. Under the heading of "minor" operations come the castration of

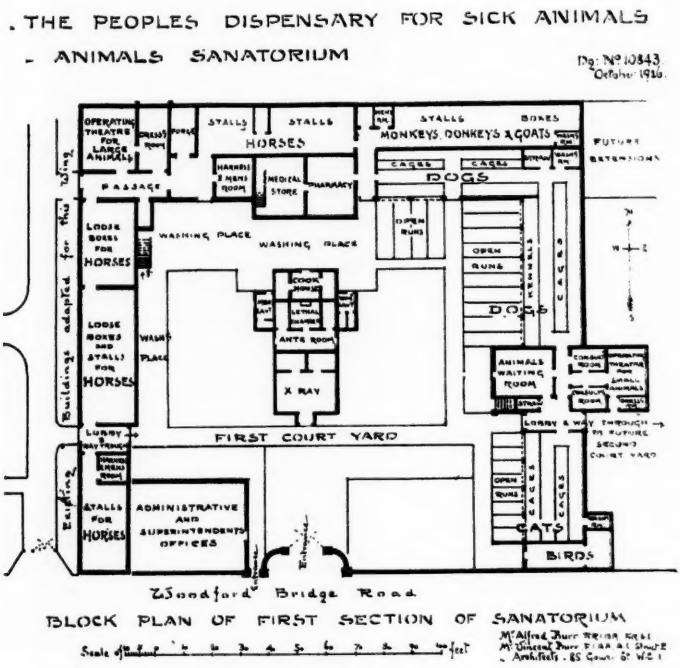

Fig. 2. Ground Plan of People's Dispensary for Sick Animals.

cats, opening of tumours and abscesses, the "setting" of fractures, the removal of eyes, and many others too numerous to mention. The dressings include canker of the ear, and wounds of which there are many varieties, usually caused by injury. Accident cases are particularly numerous at the Sanatorium and seldom a day passes without four or five such cases. Many other cases are attended to in the Clinic and many animals are able to leave with their owners after their injuries have been dressed. These are then kept under

supervision and their owners are especially warned that they must be brought up as required for further treatment.

At 9.30 a.m. junior assistants from the many dispensaries in the London area arrive for tuition. They are divided into various grades according to the length of time they have been with the Society. In the lecture rooms they are taught the different subjects of Chemistry, Physics, Botany, Zoology, Anatomy and Physiology, and, in addition, are put through the practical work in the stables. Those students in the higher grades go through a course of clinical medicine and see each case individually. Just as the medical student in his training has to "walk" the hospital wards. In the afternoons classes are held at which those students of the lower grades do practical anatomy, each individual during the course of the term dissecting the entire body of the animal. Those in the higher grades are shown the many pathological sections and attend classes in Surgical Anatomy, at which they are taught on the dead body how to perform the more common operations. All this teaching is under the direct personal supervision of the Chief of the Technical Staff, whose main ambition is to turn out men with a complete knowledge of the subject of Veterinary Medicine and Surgery. Under him are assistants, each qualified in their respective subjects to lecture and to perform their certain duties. One day per week is allotted to major operations in the new splendidly equipped operating theatre. In this the very latest animal's operating table is fitted. By means of certain fittings and adjustments a horse, or any large animal, can be put on the table whilst in a standing position and then lowered to the recumbent position for operating purposes.

The theatre, of course, is also used in emergency cases, such as accidents, etc. etc. It has only been opened during the last few weeks and is an immense asset to the Sanatorium. A new table for operations on small animals has now been added and it will be shortly put into use.

The Stores Department is busy all day, supplies of drugs, etc., being sent off to our provincial dispensaries in Liverpool, Manchester, York, Hull, Nottingham, Hastings, Brighton, Portsmouth, and many others. The London area has to be supplied with requirements as well, and this department with its own staff is occupied from morning until evening, and often in emergency cases, well into the night.

The Pharmacy, a very well appointed and equipped section, is under the supervision of a qualified M.P.S., and a staff of assistants. There they are busy making all the P.D.S.A. preparations and medicines for use in our dispensaries.

The Clinic, which is open all day, comes under the direction of the Assistant Chief of the Technical staff. Now that the public know

of its existence it has become very popular and many cases, mostly those of small animals, such as dogs and cats, are treated daily. Patients are brought by their owners from miles around and at the present time we are working very much under pressure and the number of stalls and kennels is not sufficient to cope with the demand. When the complete building is finished and our new wing added we hope then to be able to deal with all cases brought to us by people unable to afford the services of the veterinary surgeon. Before this can happen we must, however, appeal to the generosity of the animal-loving public for which this country is famed throughout the world, for subscriptions to help us to achieve our object.

Clinical Articles

Some Sheep Diseases in New Zealand.

By W. R. DAVIS, M.R.C.V.S.

PLEURISY IN SHEEP.—This is found with extraordinary frequency in some mobs of sheep (old ewes particularly). Twenty per cent. of a lot may show lesions of the malady. As a rule the lung is normal, but adhesions more or less extensive exist on one or both sides of the thorax. Quite often a small patch (without pulmonary adhesion) is seen on the costal pleura. As to the etiology of the affection it is ascribed to wet pastures, to severe weather directly after shearing, and even to rough handling at shearing. Pleurisy is not nearly so common in lambs, and in them the process is much more acute, resulting in an abundant gelatinous green coloured deposit on the costal pleura of one side only.

ECHINOCOCCUS CYSTS are present in the organs of the very great majority of cattle and sheep slaughtered in New Zealand ; the viscera involved being mostly the lungs and liver, the heart wall and kidney occasionally, and rarely the voluntary muscles. Echinococcus disease in man is common in the Dominion. I personally knew of four cases during my short residence there. Old ewes (occasionally also lambs) are often the subject of Lymphadenitis, the precrural and prescapular lymphatic glands being most frequently involved, though the popliteal gland and the kidneys, and even muscles may be affected.

As in pleurisy in sheep, so, too, in lymphadenitis in these animals. Eight thousand sheep may go through one day without a single case, and next day with sheep from a different area a very large percentage of the carcasses may be found affected. Affected animals are often in the pink of condition. Pyæmic arthritis occurs very frequently in lambs, and is responsible for great economic loss, as the leg is condemned when hock or stifle is affected. This applies also to adult sheep.

Potentially Fatal Fatigue of Cervical Muscles of the Fowl Resulting from an Excessively Large Comb.

By F. B. HUTT,

Animal Breeding Research Department, University of Edinburgh.

THERE have recently occurred at this department two cases in which a cock was reduced to the verge of death as a result of an excessively large comb, and was restored to perfect health by the

single expedient of cutting off that structure. These cases are unique in the experience of the writer, and are considered worthy of record as illustrating a condition that would seem to be a potential cause of death in the fowl.

The first bird observed was a Single Comb Brown Leghorn cockerel, No. 21 on the records of this department, hatched in May, 1927, and operated upon at six weeks of age, when the left testis and half of the right were removed. The cockerel developed normally, and at eight months was indistinguishable in appearance or behaviour from normal cocks of the same age, except that it had a rather large comb.

On January 1st, 1928, he was put in a small house with six other cockerels of the same breed and about the same age. These seven

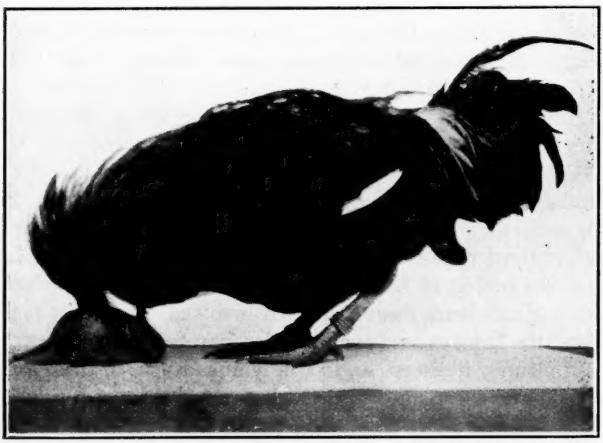

Fig. 1.

birds were used for individual matings with selected hens, the object being to determine how No. 21 and other partially castrated males compared in fertility with normal cockerels. No. 21 was the largest of the seven and was recognised by the others as ruler of the roost. By this time his comb had lopped over on one side.

On the morning of February 11th this bird was noticed standing motionless in the pen with his head bent down almost to the floor. The only signs of impaired health previously observed had been a slightly reduced activity on the preceding two days. There was no evidence of fighting or of anything else that might have injured the bird. When placed by himself in a good-sized cage his head, at first erect, slowly but inevitably sagged till his beak rested on the floor.

When roused he raised the head slightly, but almost at once it began to sink gradually back to the floor. It seemed as though his head were far too heavy for him to stand erect for any length of time.

Since the bird took no interest whatsoever in food, he was forcibly fed twice daily with pellets of moist mash. When unassisted, he made no attempt to drink. When his beak was put in water, the patient would gulp several times, but could swallow only when someone lifted his head.

On February 12th, the day after he was first noticed, all power of the flexor muscles seemed entirely gone, and when the head was lifted it dropped straight down again to the floor (Fig. 1). The extensor

Fig. 2.

muscles were able to exert pressure, and did so when the head was lifted too high or pushed back toward the body. The symptoms were not in the least suggestive of botulism or of any injury to the auditory labyrinths, either of which conditions would be accompanied by a twisting of the head to one side. Both eyes were bright and showed the usual reflex winking.

On February 14th, No. 21 was distinctly weaker. Though it was recognised that a pathological disturbance in the central nervous system might be one cause of the condition exhibited, it was decided to adopt the view that the condition was one in which the comb had increased in size by virtue of its own developmental impulses to an

extent that overtaxed the power of the muscles of the neck to support it. This view could be put to the test of experiment. If the idea were correct, a reduction in the weight of the comb should be followed by an amelioration of the condition. Accordingly, after measurements had been taken, the comb was sliced off with a razor about one half-inch from the head. In spite of its vascular appearance, the comb of the cock is composed almost entirely of connective tissue. In the present case a few drops of adrenaline stopped bleeding so effectively that not a drop of blood fell from the comb.

Measurements taken prior to its removal showed that No. 21's comb was 14·6 cm. in its longest dimension, 8 cm. high and 2·6 cm. through at its thickest point. The portion cut off weighed 58·7 grm. The body weight was 2,041 grm. on February 7th and only 1,814 grm. on February 11th.

When the bird was placed on the floor he staggered drunkenly right across the room, holding his head about 8 or 9 in. above the floor. When he ceased walking the head again sagged down, but when roused the bird was able to hold his head off the floor for over a minute. On being offered grain and water, the cockerel drank thirstily and ate voluntarily for the first time in three days.

The following morning No. 21 was found in his old position with the head on the floor, but a marked improvement was noticeable in his general demeanour when aroused. Thereafter a gradual daily improvement was noticeable, and on February 19th, five days after removal of the comb, the bird was returned to an outdoor yard, where he celebrated his recovery by lusty crowing (Fig. 2). Matings were resumed, and the fertility of his hens was soon as good as before he became incapacitated, and equal to that of normal cocks.

The history of the other case, also a Single Comb Brown Leghorn cockerel, was so like that given above that detailed description is unnecessary. In this case 19·9 grm. of wattles and 37·85 grm. of comb were removed on March 13th. Only the posterior half of the comb was removed, and the remainder seemed to weigh downward on the anterior part of the head, causing the beak to be tucked in close to the neck. Recovery was not complete till most of the remaining comb (18·2 grm.) was cut off on April 3rd. Altogether 75·95 grm. of comb and wattles were removed from this cockerel, whose body weight was 1,927 grm. prior to the operation.

This second cockerel, No. 25 of our records, had been completely castrated at nine days of age, and the removed testes implanted subcutaneously one under each wing. It is possible that the interference with the testes may have been in part responsible for an excessive growth of the comb. Greenwood and Crew[1] and Blyth[2] have put forth evidence that the development of the comb

is dependent to a considerable extent upon the degree of spermatogenic activity of the testes. No. 21 was found on *post-mortem* examination five months later to have only 5·77 grm. of testis on the left side and a regenerated nodule of ·05 grm. on the right side, but not connected with the vas deferens. It is possible that in the small fragments of testis material retained by this bird the process of spermatogenesis was proceeding during the breeding season at a much faster rate than in normal cocks and that this condition was responsible for excessive comb growth as the hypothesis of the writers mentioned would suggest. No evidence of any gross abnormality of the central nervous system was encountered. No. 25 is still living, and therefore can contribute little to this discussion.

However, several other cockerels similarly operated upon had no trouble with their combs and therefore, in the opinion of the writer, the large combs of these two cases described represent less an abnormal condition resulting from the operations to which the birds were submitted than the natural result of breeding for a large comb. In Great Britain the exhibition standard for Leghorns calls for a much larger comb than is desired in Canada and the United States. The writer has seen combs on normal Leghorn cockerels in poultry shows in this country, which were quite as big as those removed from Nos. 21 and 25. The suggestion is made that this process of breeding for large combs has brought that structure to a size where its wearer may be taxed to the limit to support it. In such exceptional cases as here described it may even grow beyond the limits of endurance of the supporting muscles and unless the cause is removed the muscle fatigue thus induced may cause death from starvation and exhaustion.

After No. 25 had completely recovered, a circlet of leaden washers weighing 50 grm. was fastened around the stub of comb remaining. This weight he was able to carry quite easily, and did so for a week. Two months later a 76 grm. leaden crown (equal to the weight of comb and wattles removed) was fastened to the top of the cockerel's head. It was not possible to attach this so that its weight acted in the same direction as the removed comb, but after four days' observation, it was evident that the extra weight was reducing the bird to a condition similar to that induced by the comb, and it was therefore removed.

Champy[3] and others have adduced considerable evidence to show that in all probability the disharmonious increase in size of a part in relation to the body as a whole has led to the extinction of species. It is easy to recognise the inevitable end of the Irish Elk, for example, if, as the individuals of that species increased in general body size at a given rate for generation after generation, the antlers, already large, increased disproportionately in size and weight.

Ultimately the head would become too heavy for the neck muscles to bear. Such heterogony (i.e. the growth of a part of the body out of proportion to the growth of the organism as a whole) must, indeed, limit the ultimate body size attainable by many species.

It would seem to be the case that there is a limit to the weight of comb which a body of limited size can sustain. If, by selection, the breeders seek to produce a Leghorn with an excessively large comb, they will probably also have to adopt the practice of "dubbing" (i.e. cutting off the comb), which, in turn, would defeat the object of breeding, or else the breed might be led to extinction. The writer does not suggest that the Leghorn fowl as a breed is doomed to such a fate, but the cases described above show that there is a limit beyond which a large comb can so interfere with the normal function of the bird as to render it non-viable.

Another reason for the preference of combs of medium rather than large size is the fact that in areas having cold winter climate loss from frozen combs is a serious problem. In Canada and the United States loss by this cause has been instrumental in establishing a preference for medium-sized combs, and an exhibition standard that would eliminate from show classes some of the large-combed Leghorns which carry off red and blue ribbons in this country.

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Neoplasms in the Fowl.

By W. R. KERR, M.R.C.V.S., D.V.S.M.,

Ministry of Agriculture, N. Ireland.

LITTLE information is available regarding neoplasms of fowl, and it thus seems of interest to report the incidence and nature of those included in certain laboratory records accessible to the writer.

The material was composed of adult fowls which had died a natural death and which were submitted for purposes of diagnosis. The large majority of the birds were females.

Usually account was taken of the presence of neoplasms only when they were regarded as directly or indirectly responsible for death. The figures given represent more the incidence of mortality due to neoplasms than the frequency of occurrence of tumours amongst fowls in general.

A total of 460 birds was examined and of these 45 or 9·78 per cent. showed the presence of neoplasms. Fifty-nine specimens were pullets from a laying test and of these 13 or 22 per cent. exhibited tumours.

In 42 of the 45 cases the neoplasms were confined to the internal organs. Excluding lymphomata, primary growths occurred most frequently (22·6 per cent.) in the female genital organs and in the intestines, while the liver was the principal seat of metastases.

A number of the tumours were examined microscopically and were classified as follows :—

LYMPHOMA.—This neoplasm was encountered in 12 cases and was invariably associated with gross enlargement of the liver and spleen and, occasionally, of the kidneys. The organs presented a mottled appearance with greyish-white, ill-defined areas throughout their substance. Naked-eye inspection is usually sufficient to establish a diagnosis.

Histological examination of five cases showed the neoplasms to be almost purely cellular, the cells resembling lymphocytes but generally rather larger. The tissue of the part was infiltrated in all directions, especially around the blood vessels.

SARCOMA.—Nine neoplasms were included in this class. The intestines, spleen, lungs, ovary, and oviduct were principally involved. In one case the primary growth was situated on the breastbone, sharply circumscribed and the size of a walnut. Secondary growths were distributed over the neck, back and legs and were smaller and poorly defined. Microscopical examination showed it to be of the small round cell type.

Other tumours in this case were small, round-celled (4), spindle-celled (2), Myxo-sarcoma (2). The usual histological structures were observed, the neoplasm being almost exclusively cellular with scanty matrix.

CARCINOMA.—Four of these tumours were recognised primarily affecting the intestines with metastases in the liver and lungs.

The essential element of the growth was the usual proliferating epithelium invading the tissue of the part.

ADENO-CARCINOMA.—Two very malignant neoplasms of this class were encountered. Both affected the intestines, especially the entrance to the caeca.

ADENOMA.—Two true ademonata were observed. One involved the terminal portion of the oviduct and occupied nearly the whole abdominal cavity. The other growth, which showed cystic degeneration, was present in the liver. This neoplasm weighed 375 grams.

FIBROMA.—Only one tumour of this class was met with, attached to the ligament of the oviduct. Another growth of almost identical structure was shown to be a lesion of *Aspergillus fumigatus*.

LIPOMA.—One lipoma was found affecting the small intestine. It was flat, diffuse, and provided with a distinct capsule. Histologically it was composed of fat cells.

It would appear from the above investigations that lymphomata and sarcomata are the commonest neoplasms of fowl.

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Abstract

The Status of Tuberculosis Eradication in the United States.*

The following is an extract from a hearing before the committee on appropriations for the federal department of agriculture quoted from pages 124-130 of the printed records of these hearings during the present session of Congress. It is arranged in the form of questions and answers, and is, in our opinion, the most complete and accurate condensed report of the progress of tuberculosis eradication ever published. Hon. L. J. Dickinson of Iowa is the chairman of the committee before which Chief Mohler of the Bureau of Animal Industry appeared.

Mr. Dickinson: We have your general statement that will go in the record, but we want you to give us the status of the operations under this fund.

Dr. Mohler: The campaign which is being conducted in co-operation with the various states, to eradicate tuberculosis from susceptible domestic livestock, has progressed during the past year in a very satisfactory manner. The work has received the support of public sentiment from both the economic and public health standpoint.

It seems to be the opinion generally that the campaign should be carried forward without interruption, to the end that all localities in the United States may be free of animal tuberculosis to the greatest possible extent; and this can be done provided ample funds are made available and the work is conducted in a well managed, orderly manner. In most of the states where animal tuberculosis is a big problem, definite programmes of procedure have been outlined to carry on the work to completion, and these anticipate the aid of the federal government in operation and indemnity.

A total of 9,700,176 cattle were tuberculin tested during the last fiscal year, which is the largest number ever tested in any previous year in the United States. These cattle were in 871,561 herds, and 285,361 reactors, or 2·9 per cent. were removed. Of the herds of cattle tested during the year, tuberculosis was found to exist on approximately one out of every ten farms on which tests were made.

There were on December 1st, 1927, 144,809 herds containing 1,997,517 cattle that were fully accredited, having passed successfully two or more tuberculin tests. This is an increase of approximately 34,333 herds in this status one year ago. In addition to these herds, there were 13,853,916 cattle in 1,706,001 herds that had passed one successful tuberculin test, many of these being located in "modified accredited areas." On December 1st, 1927, there were 2,014,950 herds containing 18,975,510 cattle under state and federal supervision

* Abstract from *The North American Veterinarian*, May, 1928.

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for the eradication of tuberculosis, and this is approximately 32 per cent. of the total cattle population of the United States. There are approximately 400,000 herds, containing about 4,200,000 cattle, that are on the waiting list to be tuberculin tested.

The greater part of the tuberculin testing is now being done under the group or area plan. Most areas consist of counties, but in some states they are limited to townships.

On December 1st, 1927, 418 counties and 16 townships were considered sufficiently free from bovine tuberculosis to be placed in the " modified accredited area." All cattle in these areas have been tuberculin tested, and reactors removed, and the infection reduced to not more than one-half of one per cent. In addition to the above mentioned counties, work on the area plan is being conducted in 627 counties, in 151 of which counties all cattle have been once tested and reactors removed, but infection not reduced to one-half of one per cent. This makes a total of 1,045 counties, or about one-third of all the counties in the United States.

During the year 1927 most of the state legislators were in session and annual state appropriations, together with county funds, amount to approximately $13,000,000 per year for this work. This includes operating expenses to the extent of $2,500,000. It is probable that about the same amount will be available during the year beginning July 1st, 1928.

It will be noted from the records that the average federal indemnity was $16·65 per head. There was an average of approximately three animals contained in each claim, making the average about $50 per owner.

Last year I reported on the activities of city health officers and the public at large in demanding a milk supply from healthy cattle. At that time it had been ascertained that approximately 1,250 cities and towns of all sizes in the United States were requiring that milk either be from tuberculin tested cattle, be pasteurized, or both.

During the present fiscal year, a new and larger survey has been made by this bureau in co-operation with the United States public health service and the bureau of dairy industry. This showed marked increase in the attention being given this matter by public health officials. The total of such cities is now, on an incomplete survey, 2,112. Of this number 1,557 require the tuberculin test, while 555 additional require the tests or permit pasteurization as an option. This phase of public health activity is a very important factor in the promotion of the test work.

This work has now progressed to such an extent that it can be safely declared that any herd of cattle, or group of herds, may be

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maintained free from bovine tuberculosis infection provided the proper care is taken to prevent reinfection. During the past year entire counties have been retested after a lapse of three years, and the result was that only slight infection was disclosed. As the work progresses it will be possible to reduce the danger of reinfection due to wider areas made free of the disease.

Mr. Buchanan: Before you leave this question, I want to know the number of cattle in the United States that have never been tested at all, and the number of cattle subjected to one test, and the number of cattle that are in accredited counties. I do not mean by counties, but just generally. I just want to know the progress of the work in a few figures.

Dr. Mohler: In 1925 there were 11,000,000 cattle under supervision. At that time there were 66,000,000 cattle in the country, so we had about one-sixth the total cattle population under supervision.

In 1926 we had 15,000,000 cattle under supervision. At that time the cattle population had decreased to 60,000,000, so it gave us a greater percentage, because we had more under supervision and there were fewer in the country. That made about one-fourth of all the cattle in the country.

Last year we tested and had under supervision 18,975,000, or practically 19,000,000 and there were only 58,000,000 cattle in the country. Therefore, about 32 per cent. of the cattle population in the country are now under supervision.

Of these 58,000,000 cattle there are about 13,000,000 calves under one year old and about 7,000,000 steers. Steers are not so susceptible to the disease, and calves are only slightly susceptible, so if you remove the steer population and the calf population you have practically 50 per cent. under supervision, that may be considered potentially dangerous of the dairy and breeding types.

When this work started in 1918 we had 4·9 per cent of all the cattle tested which reacted. Last year only 2·9 per cent reacted. That is a reduction of 2 per cent. of the whole amount. From the meat-inspection standpoint, which means dollars and cents to the producer, when this work started condemnations for cattle in our federally inspected plants were 2·4 per cent for tuberculosis. Last year it had been reduced to 1·1 per cent. Somebody is saving that difference.

In 1924 tuberculosis in hogs averaged 15·2 per cent in our federally inspected plants. In 1927 the average was only 13·5 per cent., and a great deal of that is not bovine tuberculosis. A lot of it is chicken tuberculosis. Hogs are susceptible to chicken tuberculosis, but they only get it in the glands of the throat. It condemns the head but not

the carcass. When they become infected with the cattle germ, it goes through the system and the whole carcass is very frequently condemned. So, on account of the two sources of infection of hogs—with the cattle disease and the chicken disease—it is pretty hard to tell which is which from these figures, but even at that, they show a reduction of almost 2 per cent. in three years.

At the end of 1917, the year we began this work, there were 204 accredited herds, in this country. At the end of 1927 we had 144,000 accredited herds, which is an average cleanup of 1,000 herds per month. That shows the progress, Mr. Buchanan. On an average 1,000 herds were accredited every month. In 1917 the modified accredited counties were nil. We had no modified accredited counties. At the end of 1927 we had 418 modified accredited counties, and we were doing work altogether in 1,045 counties.

There is just one other point. In October, 1927, we tested over 1,000,000 cattle. That is the high record month of the entire work.

Mr. Dickinson: What is your comment on the statement sometimes heard that tuberculin when injected into a cow causes her to abort or to become sterile.

Dr. Mohler: It cannot possibly cause either abortion or sterility. The bureau has the record of one cow which received over 1,100 cubic centimeters of tuberculin at one time and that cow lived to be 18 years old and was never known to abort. Furthermore, no cases have been recorded in the literature on the subject which would lead even to the suspicion that either abortion or sterility is caused by the injection of tuberculin. I have personally injected large numbers of pregnant cows with 30 to 80 drops of tuberculin subcutaneously which is the old method of injecting tuberculin, and have yet to see the first cow slink her calf as the result of the test. With the modern method of intradermic testing which is followed in over 90 per cent. of our work, only two drops of tuberculin are injected into the fold of the tail. To claim that such a small amount of tuberculin will produce abortion or sterility is purely a figment of the imagination and without any foundation in fact.

In connection with the co-operative tuberculosis eradication work that has been in progress for the past 10 years, many herds of breeding cattle have been placed under supervision and repeatedly tuberculin tested. In many of them infectious abortion has been eradicated during this period.

For instance almost in the shadow of this capitol building there are two government-owned herds averaging 150 to 250 cows each which have been tuberculin tested annually and sometimes semi-annually for at least two decades, and they are free not only from

tuberculosis, but from abortion as well, despite the fact that the annual tuberculin test is still being applied.

In our area work, all breeding cattle are tuberculin tested, and if tuberculin caused abortion or sterility there would undoubtedly be an abundance of evidence to prove it among the 18,975,000 cattle now under supervision.

The Status of Bovine Tuberculosis Eradication in U.S.A.*‡

	February, 1928.
Number of accredited herds	155,466
Number of accredited cattle ... ... over	2,000,000
Number of herds under supervision ... ... over	2,000,000
Number of cattle under supervision	20,098,272†
Number of modified accredited counties	464
Number of cattle tested in February, 1928	741,766
Number of reactors, February, 1928	18,000

* As a result of the eradication campaign bovine tuberculosis has been gradually reduced.

† Nearly 75 per cent. are in herds which have successfully passed one or more tuberculin tests.

‡ *North American Veterinarian*, May, 1928.

Personal

THE following appointments have recently been made :—

Chief Veterinary Officer to the County of Durham.—Major HARRY PEELE, F.R.C.V.S.

Kenya Colony.—Veterinary Officers : Mr. F. W. ASTON, M.R.C.V.S. and Mr. D. F. MACPHERSON, M.R.C.V.S.

Tanganyika Territory.—Mr. H. M. SALUSBURY, M.R.C.V.S., D.V.H.

Erratum—October Issue.

In Mr. Welch's article, page 521 line 17, the dose of "*ol crotonis 2 ounces*" should be "*2 drachms.*"

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